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| 09/363,523 | 07/29/1999 | RAJARAO JAMMY | 99-P-7722-US (8055-98) | 8231 |

7590 06/18/2002

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EXAMINER

ESTRADA, MICHELLE

ART UNIT PAPER NUMBER

2823

DATE MAILED: 06/18/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/363,523

Applicant(s)

JAMMY ET AL.

Examiner

Michelle Estrada

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8, 10-16 and 21-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-16 and 21-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-8 and 21-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur et al. in combination with Schachameyer et al. and further in view of Ho et al.

Thakur et al. disclose providing an atomically clean crystalline silicon substrate with an exposed surface (Column 4, lines 15-16); exposing the exposed surface to nitrogen to form a continuous crystalline silicon nitride layer (Column 1, lines 60-62) including the step of introducing ammonia at 850-1150 °C; depositing an amorphous silicon nitride layer over the crystalline silicon nitride layer (Column 5, line 25); and oxidizing the amorphous silicon nitride layer to form a node dielectric layer (Column 5, line 45); removing a native oxide from the exposed surface of the substrate (Col. 4, lines 24-34).

Thakur et al. do not disclose providing the atomically clean surface by precleaning the exposed surface by employing a hydrogen prebake.

Schachameyer et al. disclose precleaning an exposed silicon surface by employing a hydrogen prebake at 20 torr and 570 °C to remove native oxide and thus produce an atomically clean surface (Column 2, lines 35-68), it also includes the step of

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employing a hydrogen fluoride wet clean process to remove native oxide from the exposed surface and delay between employing the hydrogen prebake and employing the hydrogen fluoride. The reference does not disclose duration of delay, but it would have been a matter of routine optimization within the teaching of the references.

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Thakur et al. and Schachameyer et al. to obtain the atomically clean surface of Thakur et al. and further provides additional cleaning in order to avoid operator error.

The process of the combination would result in formation of crystalline silicon nitride because the same materials would be treated in the same manner as in the instant invention. Furthermore, Ho et al. discloses that an electron diffraction analysis of silicon nitride samples annealed at 1050 °C and 1100 °C were found to be crystalline structures (Col.2, line 60-Col. 3, line 15). The temperature range of Ho et al. overlaps with the range of Thakur et al.

Choice of particular conditions for the nitridation step, nitrogen pressure, hydrogen gas temperature, hydrogen gas pressure, ammonia temperature and ammonia pressure would have been a matter of routine optimization. Temperature and pressure are considered result effective variables. See MPEP 2144.05.

Claims 10-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakur et al. in combination with Schachameyer et al. and further in view of Ho as applied to claims 1-8 and 21-28 above, and further in view of Wolf, Vol. 2.

The combination of Thakur et al. and Schachameyer et al. does not disclose making the capacitor in a trench.

Wolf discloses making a capacitor in a trench (Wolf, Vol. 2, page 51) and pointed out three major purposes: "(1) to prevent latchup and to isolate n-channel from p-channel devices in a CMOS circuits; (2) to isolate the transistors of bipolar circuits; and (3) to serve as storage-capacitor structures in DRAMs". It would have been within the scope of one of ordinary skill in the art to employ the process of Wolf for its disclosed intended purpose to achieve the capacitor formation step of the combination.

Response to Arguments

Applicant's arguments filed June 11, 2001 have been fully considered but they are not persuasive. Applicant argues that the RTN processes of Thakur et al. and Ho et al. form an amorphous layer. However, as discussed above, the formation of the nitride layer of Thakur et al. and Ho et al. has overlaps on the range temperature, thus Ho et al. discloses formation of a crystalline layer within that range of temperature (Col. 2, line 60-Col. 3, line 15).

Applicant argues that the references do not disclose removing a native oxide and then a separate step of precleaning the surfaces after an amount of time has elapse by

hydrogen prebake. However, Schachameyer et al. discloses removing a native oxide and then providing a hydrogen gas, upon completion of this step, the substrate's surface is extremely clean and oxide-free. Furthermore, the time between the removing of the native oxide and providing a hydrogen gas can be considered as an amount of time that has elapse.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Wolf was disclosed to point out that trenches serve as storage capacitor structure in DRAM's.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is 703-308-0729. The examiner can normally be reached on Monday through Friday.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 (7724, 3431 and 3432) for regular communications.


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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


MEstrada
June 10, 2002


LONG PHAM
PRIMARY EXAMINER